

***Kunzea acicularis*, *K. strigosa* and *K. similis* subsp. *mediterranea*
(Myrtaceae) – new taxa from near Ravensthorpe, Western Australia**

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Abstract

Toelken, H.R. & Craig, G.F. *Kunzea acicularis*, *K. strigosa* and *K. similis* subsp. *mediterranea* (Myrtaceae) – new taxa from near Ravensthorpe, Western Australia. *Nuytsia* 17: 385–396 (2007). A re-assessment of additional material in the *Kunzea preissiana* Schauer and *K. similis* Toelken complexes resulted in two new species and a subspecies being described: *K. acicularis* Toelken & G.F.Craig, *K. strigosa* Toelken & G.F.Craig and *K. similis* subsp. *mediterranea* Toelken & G.F.Craig. A revised key to *Kunzea* Rchb. subsect. *Floridae* Toelken, a table of characters for critical species in the *K. preissiana* complex, and detailed discussions are provided.

Introduction

The following changes and additions have been made as a result of examination of additional specimens and comments received on the earlier revision of the majority of the Western Australian species (Toelken 1996). In the case of *Kunzea similis* Toelken subsp. *mediterranea* Toelken & G.F.Craig molecular fingerprinting (Krauss 2002) was also considered, but the taxonomic considerations here are predominantly morphological.

As previously described (Toelken 1996), *K. preissiana* Schauer is a complex species showing much variation throughout its wide distribution range. Herbarium specimens of the *K. preissiana* complex, and especially those of the putative hybrid, *K. affinis* S.Moore \times *K. preissiana*, were morphologically re-examined and re-assessed in view of additional field information. Re-assessment of *K. affinis* \times *K. preissiana* was required as it appeared twice in widely differing parts of the key given in Toelken (1996: 85–86, in couplets 6 & 10). In the original manuscript of that paper the two elements were named form A and B, but in the final publication they were combined because it was argued that it is only due to “limited backcrossing that they are sufficiently discrete to be individually recognised” (Toelken 1996: 31). The field observations of Dr Gillian F. Craig and Mr Geoff Cockerton have since revealed that the above plants often occurred in areas where neither of the putative parents could be found, so that after re-examination this putative hybrid is again split into two components.

Firstly, specimens similar to *K. affinis*, which are without hairs on the adaxial leaf surfaces, have almost linear leaves, bracts usually shorter than half the hypanthium, and more or less appressed stiff hairs on the inflorescence, are segregated and described as the new species, *K. strigosa* Toelken & G.F.Craig.

The second aggregate of specimens resemble *K. preissiana*, but were previously distinguished from this species because of their usually shorter and often fewer hairs on the adaxial leaf surface, rounded (but ridged) leaf apex, and bracts commonly shorter than the hypanthium. As all the characters individually and combined are at times also encountered in other material of *K. preissiana*, those specimens are now considered insufficiently distinguished and consequently included in a broader circumscription of that species. Additional variation within *K. preissiana* is discussed under that name.

During re-examination, all specimens previously included in *K. affinis* \times *K. preissiana* could be identified as one or other taxon without indication of intermediates. For example Toelken 6482 was divided into 6482A (*K. strigosa*) and 6482B (*K. preissiana*) and Canning CBG 38576 and CBG 38578, both collected "1.4 miles SSW Jerramungup", could be identified as *K. strigosa* and *K. preissiana*, respectively. Plants of the two taxa therefore sometimes grow together without recorded putative hybrids between them, and since each of them is sufficiently homogeneous it is unlikely that the specimens examined here are part of a hybrid swarm.

The new species *K. acicularis* Toelken & G.F.Craig is described following the receipt of two collections from Dr Craig (G.F. Craig 5551 & 5552) in 2002 of a form of *K. preissiana* from near Ravensthorpe with leaves "larger than typical *K. preissiana*" (G.F. Craig 5551). The plants had long spreading hairs similar to those on the form of *K. preissiana* originally described as *K. villiceus* Schauer (cf. Toelken 1996: 94), i.e. the hairs on young leaves are 1–1.4 mm long and often spreading up to about right angles to the surface. While similar long hairs and leaves are also observed on young and, especially, on coppicing shoots of plants of a wide range of forms of *K. preissiana*, this large-leaved taxon can be distinguished from the whole of the *K. preissiana* complex by the combination of three characters. Firstly, the broad leaves on the long shoots; secondly, the presence of striking long-pointed perules (distinguished from bracts higher up on the inflorescence which always have a flower in their axil) below the flower heads combined with narrowly lanceolate-triangular bracts, and thirdly, the longer, triangular calyx lobes. More detailed discussions of the morphological similarities between these species are provided under *K. acicularis*.

Table 1 provides an overview of the most important characters of various taxa accepted within the *K. preissiana* complex to facilitate quick identification, as many of the taxa are recognised by recombinations of these key characters.

In the case of *K. similis*, two widely separated populations from different environments were compared and are here recognised as subspecies. When *K. similis* was recognised (Toelken 1996) it was believed to be confined to a single locality near East Mt Barren in the Fitzgerald River National Park. It was subsequently found at Bandalup Hill at which stage a detailed impact study was compiled (Cockerton *et al.* 2002) for BHP Billiton Ltd who had pursued nickel exploration in this area. DNA fingerprinting using amplified fragment length polymorphism (AFLP) undertaken by Krauss (2002) showed five populations from the Bandalup area to be very polymorphic, but these differences showed extensive overlap. Markers of plants from East Mt Barren demonstrated significant differences from the Bandalup populations. Morphological examination of herbarium specimens confirmed a large range of variation in the Bandalup area, but also showed some differences to records from East Mt Barren. Two subspecies of this rare species are therefore described, with the name *K. similis* subsp. *mediterranea* being applied to collections from the Bandalup area.

Table 1. Distinguishing characters of six species and two hybrids in *Kunzea* sect. *Zeanuk* subsect. *Floridae*.

	Leaf shape	Leaf apex	Lamina size (mm)	Hairs on leaf adaxial/abaxial surface	Bract shape	Bract apex	Bract tomentum	Bract hypanthium length	Tomentum on hypanthium	Calyx apex	Calyx lobes
<i>K. preissiana</i>	elliptic-oblanccolate	acute-rounded	2.2-7.6 × 0.8-1.6	similar, hirsute	ovate-obovate	cuspidate-acuminate	hirsute	$(2\frac{2}{3}-) 1-1\frac{1}{3}$	hirsute	rounded	hirsute
<i>K. acicularis</i>	elliptic-oblanccolate	rounded	2.4-8.2 × 1.2-2.6	shorter on adaxial than abaxial	linear-triangular	pointed	hirsute	$2\frac{2}{3}-1$	hirsute	acute	hirsute
<i>K. jucunda</i> × <i>K. preissiana</i>	elliptic-oblanccolate	rounded	1.4-3.4 × 0.9-1.3	glabrous with marginal cilia	oblong-obovate	rounded-mucronate	strigose-pubescent	$1\frac{1}{2}-1$	± strigose-pubescent	rounded	glabrescent
<i>K. jucunda</i>	elliptic-oblanccolate	rounded	1.2-3.5 × 0.9-1.5	similar, glabrous	oblong-obovate	rounded (mucronate)	glabrous, ciliate	$7\frac{8}{8}-1$	glabrous	rounded	glabrous
<i>K. jucunda</i> × <i>K. affinis</i>	oblong-elliptic-oblanccolate	rounded	2.4-5.6 × 0.7-1.2	similar, glabrous	broad-obovate	rounded (mucronate)	glabrescent, ciliate	$1\frac{1}{3}-1\frac{1}{2}$	glabrous (glabrescent)	rounded	glabrous
<i>K. affinis</i>	linear	rounded	3.5-8 × 0.4-1.1	similar, glabrous	ovate	cuspidate-acuminate	short-hirsute-pubescent	$1\frac{1}{3}-1\frac{1}{2}$	glabrous	rounded	glabrous
<i>K. strigosa</i>	linear-club-shaped	rounded	1.8-5.6 × 0.5-1.1	adaxial glabrous, abaxial sericeous	ovate-triangular	acute-acuminate	strigose	$1\frac{4}{4}-1\frac{1}{2}$	strigose	rounded	glabrescent
<i>K. cinctinana</i>	linear-club-shaped	rounded	2.8-7.3 × 0.7-0.95	similar, ± hirsute, loosely strigose	ovate-oblong-ovate	pointed	hirsute	$1-1\frac{1}{3}$	hirsute	rounded	± hirsute

Methods

The general arrangement of the species accepted by Toelken (1996) is here retained and the additional species have been intercalated. The numbering of the species is increased by two in anticipation of *K. baxteri* (Klotzsch) Schauer and *K. pulchella* (Lindl.) A.S.George being included next to *Kunzea* Rchb. sect. *Zeanuk* Toelken, as shown by molecular analyses to be published shortly, and inserted at numbers one and two. Only those taxa described here as new or having been re-examined and taxonomically re-assessed are discussed below. Reference is made to AFLP analyses performed by Krauss (2002), with methods contained therein. Herbarium acronyms follow Holmgren and Holmgren (1998–) except for RAV. which refers to the Western Australian regional herbarium at Ravensthorpe. Specific locality information has been obscured from cited specimens of conservation listed taxa.

Key to species, subspecies and putative hybrids of *Kunzea* subsect. *Floridae*

Notes. The size and shape, as well as tomentum, of the first three leaves produced on each new branch are often abnormal and should not be used. The tomentum of the leaves is here based on young leaves on developing long shoots, and at least two or three leaves should be examined.

- 1. Ovary with 2 locules, each with 1 or 2 ovules; leaves club-shaped
and with straight appressed hairs..... 25. *K. eriocalyx*
- 1: Ovary with 5, rarely 3 locules, each with 6 or more ovules; leaf
lamina linear, elliptic or if oblanceolate then \pm flat and with
tomentum varying, but if somewhat club-shaped then with
 \pm coiled hairs
- 2. Young leaves on long shoots hairy on both surfaces; calyx lobes
densely hairy, at least when young
- 3. Hairs on leaves and branches coiled
- 4. Leaves club-shaped, (2.8–)3.5–6.4(–7.3) mm long..... 24. *K. cincinnata*
- 4: Leaves linear-elliptic, dorsiventrally compressed,
2.1–3.2 mm long 20(i). *K. cincinnata* \times *K. jucunda*
- 3: Hairs on leaves and branches straight or irregularly twisted
- 5. Ovary 3-locular; calyx lobes pointed; leaves glabrescent or
less densely hairy adaxially than abaxially
- 5A. Bracteoles 3.2–3.5(–3.7) mm long, hidden..... 16a. *K. similis* subsp. *similis*
- 5A: Bracteoles 3.8–4.2(–4.4) mm long, apex exposed..... 16b. *K. similis* subsp. *mediterranea*
- 5: Ovary 5-locular; calyx lobes bluntly acute to rounded and
leaves with varying tomentum, but if the former pointed,
then leaves \pm densely hairy on both surfaces
- 6. Hairs on adaxial surface of leaves shorter and fewer than
on abaxial surface
- 6A. Bracts shorter than half the hypanthium; leaf lamina
linear-oblanceolate to club-shaped (0.5–)0.6–0.8(–1.1) mm
broad; tomentum on branches and leaves appressed
(strigose) 23. *K. strigosa*
- 6A: Bracts usually longer than half, and usually as long as, the
hypanthium; leaf lamina oblong-elliptic to oblanceolate
(0.8–)1.0–1.3(–1.6) mm broad; tomentum on branches
and leaves loosely appressed (pubescent)..... 19. *K. preissiana*

- 6: Hairs on both leaf surfaces equally long and dense
- 7: Bracts acute to acuminate, densely covered with spreading hairs; hairs on leaves and inflorescence 0.4–1.2 mm long
- 7A: Leaf lamina (broader) (1.2–)1.5–2.2(–2.6) mm broad; calyx lobes acute to pointed 20. *K. acicularis*
- 7A: Leaf lamina (narrower) (0.8–)1.0–1.3(–1.6) mm broad; calyx lobes obtuse to rounded unless folded lengthwise 19. *K. preissiana*
- 7: Bracts rounded rarely with bluntly acute or mucronate apex, with hairs dense to becoming patchy and \pm appressed; hairs on leaves and inflorescence 0.15–0.25 mm long 15(iii). *K. micromera* \times *K. preissiana*
- 2: Young leaves on long shoots glabrous on adaxial surface; calyx lobes glabrescent to glabrous
- 8: Calyx lobes acute, rarely folded
- 9: Hypanthium, calyx lobes and bracts glabrous 18. *K. pauciflora*
- 9: Hypanthium, calyx lobes and bracts hairy 17. *K. acuminata*
- 8: Calyx lobes bluntly acute to rounded unless folded
- 10: Hypanthium and calyx glabrous
- 11: Young branches with long appressed hairs
- 12: Leaf lamina linear; bracts usually beaked or acute 22. *K. affinis*
- 12: Leaf lamina elliptic; bracts rounded rarely mucronate 22(i). *K. affinis* \times *K. jucunda*
- 11: Young branches glabrous or with a few spreading hairs 21. *K. jucunda*
- 10: Hypanthium and/or calyx glabrescent (tomentum of calyx often varying from lobe to lobe)
- 13: Bracts rounded, rarely mucronate; leaf lamina (1.5–)2–2.5(–3) times longer than broad 21(iii). *K. jucunda* \times *K. preissiana*
- 13: Bracts acute to acuminate to cuspidate; leaf lamina (3–)4–6(–8) times longer than broad 23. *K. strigosa*
16. *Kunzea similis* Toelken, *J. Adelaide Bot. Gard.* 17: 86 (1996). Type: East Mt Barren, 8 October 1979, H.R. Toelken 6500 (holo: AD; iso: G, K, MO, NSW, PERTH, S).

Illustration. Toelken (1996) p. 87, Figure 15.

16a. *Kunzea similis* subsp. *similis*

Shrubs up to 1.5 m tall. *Bracteoles* 3.2–3.5(–3.7) mm long, hidden between flowers and usually shorter than the hypanthium.

Specimens examined. See Toelken (1996: 88).

Distribution and ecology. Growing in fine clayey sand on slope with sparse low heath in Fitzgerald River National Park near Hopetoun, Western Australia.

Flowering period. September and October.

Conservation status. *Kunzea similis* is listed as a Declared Rare Flora (DRF) under the Western Australian Wildlife Conservation Act 1950 (Atkins 2006). *Kunzea similis* subsp. *similis* is conserved in a National Park.

16b. *Kunzea similis* subsp. *mediterranea* Toelken & G.F.Craig, subsp. nov.

A subspecies typica fruticibus usque ad 3 m altis, bracteolis 3.8–4.2(–4.4) mm longis differt.

Typus: east of Ravensthorpe, Western Australia [precise locality withheld for conservation purposes], 14 November 2004, *Landcare Services* LCS 10221 (*holo:* PERTH 07344236; *iso:* AD, MEL, NSW).

Shrubs up to 3 m tall. *Bracteoles* 3.8–4.2(–4.4) mm long, with apex usually exposed and often longer than hypanthium.

Specimens examined. WESTERN AUSTRALIA: [localities withheld] 13 Sep. 2004, *M. Bennett* 965 (PERTH); Oct. 2000, *G. Cockerton* & *A. Kalotas* LCS 7382 (PERTH); 17 Feb. 1998, *G.F. Craig* 3573 (AD, PERTH, RAV.); *s. dat.*, *S. Kern* & *K. Mappin* LCS 11521 (PERTH); *s. dat.*, *S. Kern* & *K. Mappin* LCS 11577 (PERTH); *s. dat.*, *S. Kern* & *K. Mappin* LCS 12020 (PERTH).

Distribution and ecology. Restricted to the Bandalup Hill area where it is growing on the ridge top in grey loamy sand over laterite in open shrub mallee and dense heath. Associated with *Eucalyptus* × *tetragona*, *Banksia lemanniana*, *Isopogon trilobus* and *Jacksonia elongata*.

Flowering period. September to November.

Conservation status. As the circumscription of the DRF *K. similis* has not changed, this subspecies also has DRF status. Not conserved in a reserve and threatened by mining activity in the present location. The mining company active in this area is committed to preserve c. 13 ha at Bandalup Hill, where many thousands of plants of this genetically very variable population of *K. similis* occur (*G. Cockerton*, pers. comm. 7/4/2003).

Etymology. While the typical subspecies was found close to the sea this subspecies derives its epithet *mediterranea* (Latin, “inland”) from its locality well away from the coast.

Variation. Specimens of this subspecies generally had narrower leaves but broader ones, particularly on long shoots, were also observed, thus showing a definite overlap with those of plants from East Mt Barren. Leaves on plants from the Bandalup Hill area usually have an obtuse to rounded apex, but acute apices can also be found. Likewise, the tomentum shows much more variation in the latter area than on plants from East Mt Barren.

19. *Kunzea preissiana* Schauer, Lehm. *Pl. Preiss.* 1:125 (1844). *Type:* Western Australia, without precise locality, *s. dat.*, *Preiss* 276 (*lecto:* LD, *fide* Toelken 1996: 92).

Illustration. Toelken (1996) p. 93, Figure 18.

Selected specimens examined. WESTERN AUSTRALIA: E Stirling Range, Oct. 1903, *C. Andrews s.n.* (PERTH); Borden, 30 Sep. 1963, *A.M. Ashby* 527 (AD); W Buniche, Biddy Camm Road, 25 Sep. 1994, *E. Bishop* 38 (PERTH); Porongurup, 5 Oct. 2000, *A. Burchell* 374 (PERTH); sources of Blackwood

River [sic], 1893, *Miss Cronin s.n.* (MEL 92665); Bendering, 18 Oct. 1949, *C.A. Gardner* 9460 (PERTH); 5 km S Kukerin, S of Siberia Rd, 14 Oct. 2003, *J. Gray* 115 (PERTH); Mt Chudalup, 29 Oct. 1972, *G.J. Keighery* 1399 (KPBG); Nyabing, Oct. 1956, *V.F. McDougall* 50 (PERTH); 8 km NNE Kukerin, 4 Nov. 1992, *S.A. McNee* DY 666 (PERTH); Needilup Hill, 30 Sep. 1962, *K. Newbey* 507 (PERTH); c. 15 km NE Arthur River, 28 Oct. 1998, *L.W. Sage* 1201 & *F. Obbens* (PERTH); 39 km NW Corrigin, 14 Oct. 1976, *C.I. Stacey* CIS 573 (PERTH); 23 km W Gairdner Station, 7 Oct. 1979, *H.R. Toelken* 6482B (AD, PERTH); 4 km S Qualup H.S., 29 Oct. 1981, *H.R. Toelken* 7134 (AD, PERTH); Cascade–Lake King road, 3 Oct. 1994, *C.D. Turley* 11/1095 (PERTH); Wickepin–Harrismith, 22 Oct. 1972, *E. Wittwer* 885 (CANB, PERTH); Harrismith, 8 Oct. 1977, *E. Wittwer* 2057 (PERTH); N Chillinup, 15 Oct. 1977, *E. Wittwer* 2087 (PERTH); 45.6 mls W Ravensthorpe, 12 Oct. 1967, *D. Young* 328 (PERTH).

Variation. Toelken (1996: 94) recorded much variation for *K. preissiana* and discussed three forms in more detail. The first form, which is distinguished by longer spreading hairs on its flowers and leaves, occurs mainly south of the Stirling Range and is very similar to the new species, *K. acicularis* (distinguished as described below). However, as the tomentum of *K. preissiana* varies not only on different forms but also on different organs, and it depends on how it wears off on different forms over time, this character was limited for critical analyses to the hairs on young leaves on long shoots.

The circumscription of *K. preissiana* is broadened with respect to forms 2 and 3, which mainly occur north of the Stirling Range and have shorter, more or less appressed hairs on leaves. While the tomentum of leaves of form 1 is about equally dense on both leaf surfaces, the hairs on the adaxial surface of leaves of form 2 and, particularly, 3 are fewer and shorter than those on the abaxial surface. Thus “its [*K. preissiana*] distinction from its hybrids with *K. affinis* and *K. jucunda* become blurred” (Toelken 1996: 94). However, *K. affinis* × *K. preissiana* is here split into *K. strigosa* (fully distinguished under that species), mainly on account of its glabrous adaxial leaf surface, and a more broadly circumscribed *K. preissiana*, in which leaves vary from being as densely hairy on the adaxial as the abaxial surface, to having sparser and shorter hairs on the adaxial surface.

The distinguishing characters between the forms occurring to the south and north merge in the Stirling Range, but none of the specimens of various populations examined show the extreme variation normally observed in hybrid swarms of taxa in *Kunzea*. Individual populations seem to be stable with one or more characters of the northern or southern form predominating. The phenomenon cannot at present be explained by hybridization or the more gradual change, and often directional distribution, of characters indicative of introgression or clinal variation.

Kunzea preissiana can be distinguished from the very similar *K. acicularis* by the combination of the three characters outlined previously. However, leaves on the fast-growing long shoots of some plants of *K. preissiana*, particularly from the area between Gnowangerup to Jerramungup (e.g. Gnowangerup, *C.A. Gardner* 994, PERTH), sometimes approach the breadth of those seen in *K. acicularis*. Similarly, where *K. acicularis* has long-pointed perules which are, like the bracts, narrowly lanceolate-triangular, those of typical *K. preissiana* plants are ovate to obovate. However, there are exceptions of the latter (e.g. Dryandra State Forest, *E.C. Nelson s.n.*, ANU16917, PERTH), which have similar narrower perules/bracts with a characteristic acicular terminal acumen, but their leaves are narrower and they have short, obtuse calyx lobes. The calyx lobes of *K. acicularis* are triangular and longer [(1.0–)1.2–2.1(–2.3) mm long] than those of *K. preissiana*, which are ovate, obtuse and (0.8–)1.0–1.2(–1.4) mm long. The latter, however, sometimes may appear acute, because they become more or less folded lengthwise when dried. Here too exceptions among specimens of the latter have been recorded (e.g. Red Gum Pass, *A.M. Ashby* 1969, PERTH), but they are also distinguished by

broader leaves and ovate bracts.

20. *Kunzea acicularis* Toelken & G.F.Craig, *sp. nov.*

Kunzea preissianae Schauer similis sed foliorum lamina (1.2–)1.5–2.2(–2.6) mm lata, calicis lobis acutis triangularibus et perulis vel bracteis anguste lanceolato-triangularibus acumenibus acicularibus differt.

Typus: north-east Ravensthorpe, Western Australia [precise locality withheld for conservation purposes], 6 November 2001, *G.F. Craig* 5551 & *K. Menandue* (*holo*: PERTH; *iso*: AD, CANB, K, MEL, NSW).

Shrubs up to 2 m tall, with few erect stems each little- and irregularly- branched often with short branches; young branches with flanges indistinct and usually only along part of the internodes, densely covered with fine (long and short) spreading hairs; early bark longitudinally irregularly fissured, fibrous-peeling, grey. *Leaves*: *petiole* 0.3–0.7 mm long, more or less appressed; *lamina* oblanceolate to elliptic-oblanceolate, (2.4–)3.5–6(–8.2) × (1.2–)1.5–2.2(–2.6) mm, obtuse to rounded, rarely acute when young, gradually constricted into petiole, concave with lateral margins more or less incurved or rarely flat above, slightly convex to ridged below, somewhat appressed on long shoots, spreading on short ones, densely covered with long fine hairs on both surfaces and spreading about right angles (60–90°) when mature. *Inflorescence* a botryum with (1–)3–5(–6) flowers, terminal on short or rarely on long shoots, with mainly terminal growth after flowering but sometimes especially on short shoots immediately branching above botryum; *perules* usually few and sometimes caducous, triangular often narrowly so, 1.8–2.5 mm, pointed, with one central vein, densely covered outside with more or less spreading hairs; *bracts* narrowly triangular, 2.8–3.3(–3.5) × 0.9–1.3 mm, pointed, usually with one vein from the base, more or less densely covered outside with spreading hairs but often wearing off towards the apex; *bracteoles* in pairs, linear-triangular to linear, 3.1–3.6 × 0.25–0.50 mm, pointed, with one central vein, densely covered outside with long spreading hairs. *Hypanthium* 3.3–3.8 mm long when flowering (free tube 1.4–2.2 mm long), densely covered with spreading antrorse hairs. *Calyx lobes* triangular to triangular-lanceolate, 1.5–1.8 mm long, acute to pointed, margins slightly incurved, densely covered outside with long antrorse hairs, rarely becoming glabrous towards the apex. *Corolla lobes* orbicular, 3.3–4 mm long, with claw almost absent, pink to mauve. *Stamens* c. 26 in more than one whorl, usually longer than corolla lobes; *filaments* 4.9–6.8 mm long; *anthers* 0.4–0.5 mm long, with large subterminal gland. *Ovary* with 5 locules, surmounted by a style base partly sunk into the upper surface; *placenta* a narrowly elliptic disc, little fleshy, with ascending attachment connected to middle, with lobes only connate on the outside margins, each lobe with one row of ovules; *ovules* 9–12 per locule, spreading or lower ones pendulous and often slightly longer; *style* 5.8–6.6 mm long, scarcely broadened towards the base; stigma capitate and little depressed at apex, often at a slight angle. *Fruit* an urceolate capsule, usually with 5 vertical ridges partly hidden in the tomentum, with calyx lobes spreading. *Seed* unknown.

Specimens examined. WESTERN AUSTRALIA: [localities withheld] 15 Sep. 2004, *M. Bennett* 970 (PERTH); 26 Nov. 2004, *J.A. Cochrane* 5115 & *S. Gilfillan* (PERTH); 4. Nov. 2001, *G. Cockerton* LCS 8195 (PERTH); 20 Sep. 2003, *G. Cockerton* 8227 (PERTH); 4 Nov. 2001, *G. Cockerton* & *G.F. Craig* LCS 8194 (PERTH); 8 Sep. 1993, *G.F. Craig* 2866 (PERTH); 4 Feb. 2004, *G.F. Craig* 6042A (AD, PERTH, RAV.); 4 Feb. 2004, *G.F. Craig* 6042B (AD, PERTH); 6 Nov. 2001, *G.F. Craig* 5552 & *K. Menandue* (AD, PERTH); 20 Nov. 2003, *N. Evelegh* LCS 8227 (PERTH).

Specimens examined of typical *K. preissiana* from areas close to *K. acicularis* (cf. Toelken 1996: 95). WESTERN AUSTRALIA: W Ravensthorpe, 16 Oct. 1964, J. Galbraith 1064 (MEL); Ravensthorpe, Nov. 1932, H. Steedman s.n. (PERTH).

Distribution and ecology. Growing on pale orange clay-loam, with laterite or quartzite small stones and chips on the surface, in open mallee and heath on upper slope or low rise in undulating plain, north-east of Ravensthorpe. It is often associated with *Eucalyptus pleurocarpa*, *E. tetraptera*, *Andersonia parvifolia*, *Melaleuca societatis* and *M. uncinata*.

Flowering period. October and November.

Conservation status. Listed as Priority One under DEC Conservation Codes for Western Australian Flora (Atkins 2006). Known only from a very restricted distribution and not in a conserved area.

Etymology. The epithet *acicularis* (Latin, “needle-like”) refers to the long needle-like acumen of the perules and bracts.

Diagnostic features. Similar to the southern form of *K. preissiana*, which produces similar straggly shrubs covered with long spreading hairs, which are usually longer than 1 mm. Both have bracts longer than half the hypanthium. *Kunzea acicularis* differs from *K. preissiana* by the combination of the following characters: being usually taller, having broader leaves and lanceolate-triangular long-pointed perules and bracts on the inflorescence, as well as longer, acute, triangular calyx lobes.

Variation. The margins of the perules and bracts are often incurved accentuating the needle-like shape.

21. *Kunzea jucunda* Diels, in F.L.E. Diels & E. Pritzel, *Bot. Jahrb. Syst.* 35: 424 (1905). *Type:* Western Australia, Mongerup near Salt River, F.L.E. Diels 4719 (*holo:* B†; *iso:* PERTH, *fide* Toelken 1996: 95).

Illustration. Toelken (1996) p. 96, Figure 19.

Putative hybrid

21(iii). *K. jucunda* × *K. preissiana* (*fide* Toelken 1996: 97).

Although Toelken (1996: 94) commented that the “distinction” between *K. preissiana* and *K. jucunda* × *K. preissiana* becomes occasionally “blurred”, this hybrid is retained as no additional information has become available. It is distinguished by its very broad rounded bracts and usually irregularly hairy (some glabrescent) calyx lobes. Intermediates may be due to backcrossing between the putative hybrid and the two parental species.

22. *Kunzea affinis* S.Moore, *J. Linn. Soc. Bot.* 45: 2002 (1920). *Type:* Western Australia, arid plains, Gardner and Fitzgerald Rivers, G. Maxwell 211 (*holo:* BM, *fide* Toelken 1996: 98).

Illustration. Toelken (1996) p. 99, Figure 20.

The concept of *K. affinis* remains the same as used in Toelken (1996). In the key to species published there, *K. strigosa* now replaces much of *K. affinis* × *K. preissiana*.

Putative hybrid

K. affinis × **K. preissiana** (*fide* Toelken 1996: 100).

No convincing evidence could be found to identify any of the existing specimens as this putative hybrid, however unlikely this would seem judging by the records of their presence between most species in *Kunzea* subsect. *Floridae* Toelken. Most of the specimens previously cited are now referred to *K. strigosa*, but also a few are transferred to *K. preissiana* (*cf.* discussion there).

23. Kunzea strigosa Toelken & G.F.Craig, *sp. nov.*

A *Kunzea affine* S.Moore hypanthio lobisque calicis strigosis, pagina abaxiale foliorum sericea, floribus sessilibus; a *K. cincinnata* Toelken pilibus rectis in ramis foliisque, tomento plus minusve adpresse in hypanthio lobisque calicis, bracteis bracteolisque brevioribus et acutioribus differt.

Typus: 13 km from Ravensthorpe to Hopetoun, Western Australia, 11 September 1983, *J. Taylor* 1707 & *P. Ollerenshaw* (*holo*: PERTH; *iso*: CANB *n.v.*, MEL *n.v.*).

K. preissiana auct. non Schauer, W.E. Blackall & B.J. Grieve, West. Austr. Wildflow. Edn 2, Vol. 3A: 100 (1980), *p.p.*

K. affinis × *K. preissiana* Toelken, *J. Adelaide Bot. Gard.* 17: 100 (1996), *p.p.*

Shrubs 1–1.3(–2) m tall, with a few erect cane-like stems each with mainly vegetative growth towards the base and upper branches with more or less short lateral branches; young branches with indistinct flanges, sparsely covered with fine (long and short) appressed hairs; early bark repeatedly longitudinally splitting, with fibrous margins scarcely peeling, pale brown. *Leaves*: *petiole* 0.4–1.0 mm long, more or less appressed; *lamina* linear, rarely linear-elliptic to oblanceolate, (1.8–)2.5–5.0(–5.6) × (0.5–)0.6–0.8(–1.1) mm, obtuse to rounded, gradually constricted into petiole, flat to concave or grooved and glabrous above, strongly convex and sericeous to glabrescent with fine straight appressed hairs below. *Inflorescence* a botryum with 3–5(–7) flowers, terminal on and mainly a single inflorescence on each lateral short shoot, with mainly terminal growth after flowering but sometimes especially on short shoots branching immediately below the inflorescence; *perules* 2, 3, rarely more, triangular to ovate-triangular, 1.1–1.8 mm, more or less pointed, with one central vein, densely covered outside with long antrorse hairs, rarely only along the margins; *bracts* ovate-triangular, 1.4–2.2 × 0.9–1.3 mm, shortly pointed to cuspidate or acuminate on upper flowers, usually with 1 vein from the base, densely covered with long antrorse hairs on outside; *bracteoles* paired, linear-oblanceolate, often somewhat falcate, 1.2–1.6 × 0.2–0.4 mm, pointed, with one central vein, densely covered outside with long antrorse hairs. *Hypanthium* 1.9–2.6 mm long when flowering (free tube 1.3–1.5 mm long), densely covered with long antrorse hairs. *Calyx lobes* broadly ovate, 1.0–1.25 mm long, bluntly acute to rounded, margins scarcely incurved, more or less densely covered usually with short antrorse hairs, glabrescent rarely glabrous. *Corolla lobes* orbicular-obovate to depressed-obovate, 2.5–3.3 mm long, more or less clawed, usually deep mauve. *Stamens* 17–23 in more than one whorl, usually longer than corolla lobes; *filaments* 2.5–3.1 mm long; *anthers* 0.5–0.6 mm long, with small subterminal gland. *Ovary* with 3–5 locules, surmounted by a style base partly sunk into the upper surface; *placenta* a narrow-elliptic disc, little fleshy, with ascending attachment connected to the middle, with lobes mainly connate to the outside margins, each lobe with one row of ovules; *ovules* (8–)10–12 per locule, more or less pendulous, elongate; *style* 3.4–4.0 mm long, scarcely broadened towards the base; *stigma* capitate with small depression in its centre. *Fruit* an urceolate capsule, scarcely ridged with erect calyx lobes. *Seed* unknown.

Selected specimens examined. WESTERN AUSTRALIA: Oldfield Location 811, SW Ravensthorpe, 22 Sep. 2004, *S. Barrett* 1289 (PERTH); 12 km E Gairdner River, 18 Oct. 1964, *J.S. Beard* 3649 (PERTH); 1.4 mls SSW Jerramungup, 1 Nov. 1968, *E.M. Canning s.n.* (CBG 38576) (CANB, PERTH); Bandalup Hill, 15 Aug. 2000, *G. Cockerton & A. Kalotas* 7305 (PERTH); Bandalup Hill, 20 Feb. 1998, *G.F. Craig* 3673 (AD, PERTH); 2.5 km W Bandalup Hill trig., 9 Nov. 2000, *G.F. Craig* 5220 (AD); road between Munglinup and Young River, 17 Oct. 1965, *N.N. Donner* 1559 (AD); Jerramungup, 9 Oct. 1967, *A.R. Fairall* 2328 (KPBG, PERTH); E Stirling Ranges, Oct. 1903, *W. Fitzgerald s.n.* (NSW 124067); 13 mls E Jerramungup, 23 Sep. 1962, *K. Newbey* 481 (PERTH); 32 km NNE of coast of Stokes Inlet, 18 Oct. 1968, *A.E. Orchard* 1628 (AD, CANB, PERTH); northern boundary of Fitzgerald River National Park, 21 Oct. 1970, *R.D. Royce* 9174 (PERTH); 26.8 km W Oldfield River, 3 Oct. 1981, *R. Spjut et al.* 7328 (PERTH); 34 km S Ravensthorpe, 6 Sep. 1976, *C.I. Stacey* CIS 549 (PERTH); 16 km S Jerramungup, 24 Oct. 1982, *A. Strid* 20991 (G, K); 23 km W Gairdner Station, 7 Oct. 1979, *H.R. Toelken* 6482A (AD, PERTH); 19.5 km N Telegraph Rd on Hamersley Rd, 31 Oct. 1981, *H.R. Toelken* 7158 (AD, PERTH); c. 22 km N Shoal Cape, 25 Sep. 1968, *P.G. Wilson* 7804 (PERTH); 72 mls Albany to Jerramungup, 26 Oct. 1968, *J.W. Wrigley s.n.* (CBG 36378) (CANB, NSW); 8.6 mls S Ravensthorpe, 10 Oct. 1967, *D. Young* 277 (PERTH).

Distribution and ecology. From east of Stirling Range, mainly between Jerramungup and east of Ravensthorpe, but also eastwards to near Esperance. Recorded from sandy to clay loams; often a dominant species in heath on eastern mid- and lower slopes of low ridges and shallow, probably winter-moist, hollows between ridges.

Flowering period. August to November.

Conservation status. Not considered threatened as it is relatively widespread and common throughout the region. *G.F. Craig* 5220 recorded it as "locally abundant in heath pockets, occasional and scattered on ridge-top".

Etymology. The specific epithet, *strigosa* (Latin, "with sharp appressed hairs"), refers to the strigose tomentum on the branches, bracts, bracteoles and hypanthium of this species. The more or less appressed hairs on the inflorescence may be soft to touch but are much more rigid than the fine hairs on the leaves, for instance.

Diagnostic features. *Kunzea strigosa* is superficially similar to *K. affinis* but distinguished from it by a hairy hypanthium and calyx lobes, young leaves which are hairy to glabrescent on the abaxial leaf surface, flowering main branches which rarely have more than one inflorescence on lateral branches, and flowers which are usually quite sessile. The hairy flowers resemble those of *K. cincinnata* Toelken, but in the latter the hairs are spreading up to 90° to the surface and are more or less crisped or coiled, there are crisped hairs on the adaxial leaf surface, and the bracts and bracteoles are longer and pointed. Other specimens previously included in the hybrid, *K. affinis* × *K. preissiana* (see detailed discussion under *K. preissiana*) can also be distinguished from *K. strigosa* by their broader, usually linear-oblong leaves with an abaxial ridge at least towards the apex. They also often have appressed hairs on their adaxial surface, but then fewer than abaxially and for a short time only, while there are spreading hairs (hirsute tomentum) on the inflorescence. In an extreme case of *K. preissiana* (Mt Chudalup, *G.J. Keighery* 1399) the leaves are more or less linear and with rounded apices, but they are ridged, although generally flat, with sharp margins quite unlike the club-shaped leaves of *K. strigosa*, which occurs to the east of the Stirling Range.

Variation. While the hypanthium, with its long antrorse hairs, is rarely glabrescent, the much shorter hairs on the calyx often wear off or are sometimes very sparse initially (e.g. Stokes Inlet, *A.E. Orchard* 1628). This glabrescent calyx was mainly observed on records from the eastern parts of its distribution, but was also observed to a lesser degree in *K. cincinnata* and rarely in *K. preissiana* (e.g. some flowers of *C.A. Gardner* 13776, PERTH).

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